What is claimed is

~~U.S. CLAIMS~~

1. A method of designing a digital filter, including the steps of

determining a real-valued discrete-frequency representation of a desired full length digital filter;

transforming said discrete-frequency representation into a corresponding discrete-time representation;

circularly shifting said discrete-time representation; and

applying a shortening window to said discrete-time representation to produce a zero-padded reduced length filter.

2. The method of claim 1, further including the step of circularly shifting said reduced length filter to remove leading zeroes.

3. The method of claim 1 ~~or 2~~, wherein said real-valued discrete-frequency representation is formed by a noise suppressing spectral subtraction algorithm.

4. The method of claim 1 ~~or 2~~, wherein said real-valued discrete-frequency representation is formed by a frequency selective non-linear algorithm for echo cancellation.

5. The method of claim 1, wherein said window is a Kaiser window.

6. The method of claim 1, further including the step of transforming said reduced length filter into a minimum phase filter.

7. A digital convolution method, including the steps of

determining a real-valued discrete-frequency representation of a desired full length digital filter;

transforming said discrete-frequency representation into a corresponding discrete-time representation;

circularly shifting said discrete-time representation;

applying a shortening window to said discrete-time representation to produce a zero-padded reduced length filter; and

convolving an input signal with said zero-padded reduced length filter.

8. The method of claim 7, including the step of circularly shifting said reduced length filter to remove leading zeroes.

9. The method of claims 7, including the step of transforming said reduced length filter into a minimum phase filter.

10. The method of claim 7, 8 or 9, including the step of performing the convolution step in the time domain using the discrete-time representation of said reduced length filter.

11. The method of claim 7, 8 or 9, including the step of performing the convolution step in the frequency domain by using the overlap-add method.

12. The method of claim 7, 8 or 9, including the step of performing the convolution step in the frequency domain by using the overlap-save method.

13. A digital filter design apparatus, including

means for determining a real-valued discrete-frequency representation of a desired full length digital filter;

means for transforming said discrete-frequency representation into a corresponding discrete-time representation;

means for circularly shifting said discrete-time representation; and

means for applying a shortening window to said discrete-time representation to produce a zero-padded reduced length filter.

14. The apparatus of claim 13, including means for circularly shifting said reduced length filter to remove leading zeroes.

15. The apparatus of claim 13 ~~or 14~~, wherein said window applying means implements a Kaiser window.

16. The apparatus of claim 13, including means for transforming said reduced length filter into a minimum phase filter.

17. A digital convolution apparatus, including

means for determining a real-valued discrete-frequency representation of a desired full length digital filter;

means for transforming said discrete-frequency representation into a corresponding discrete-time representation;

means for circularly shifting said discrete-time representation;

means for applying a shortening window to said discrete-time representation to produce a zero-padded reduced length filter; and

means for convolving an input signal with said zero-padded reduced length filter.

18. The apparatus of claim 17, including means for circularly shifting said reduced length filter to remove leading zeroes.

19. The apparatus of claims 17, including means for transforming said reduced length filter into a minimum phase filter.

20. The apparatus of claim 17, ~~18 or 19~~, including means for performing the convolution step in the time domain using the discrete-time representation of said reduced length filter.

21. The apparatus of claim 17, ~~18 or 19~~, including means for performing the convolution step in the frequency domain by using the overlap-add method.

22. ~~The method of claim 17, 18 or 19, including means for performing the convolution step in the frequency domain by using the overlap-save method.~~